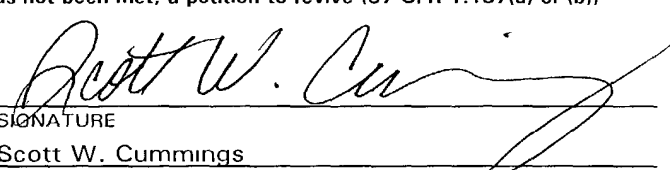


FORM-PTO-1390 (Rev. 9-2001)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 024445-008	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) <div style="font-size: 1.5em; font-weight: bold;">10/019778</div>	
INTERNATIONAL APPLICATION NO. PCT/SE00/01416		INTERNATIONAL FILING DATE 04 July 2000		PRIORITY DATE CLAIMED 05 July 1999	
TITLE OF INVENTION LOADING SYSTEM FOR PVD COATING OF CUTTING INSERTS					
APPLICANT(S) FOR DO/EO/US Tor NORRGRANN and Ingemar HESSMAN					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below. 4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31). 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input checked="" type="checkbox"/> has been communicated by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto. b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input checked="" type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 					
Items 11 to 20 below concern document(s) or information included:					
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input type="checkbox"/> A FIRST preliminary amendment. 14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 15. <input type="checkbox"/> A substitute specification. 16. <input type="checkbox"/> A change of power of attorney and/or address letter. 17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825. 18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4). 19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4). 20. <input checked="" type="checkbox"/> Other items or information: International Search Report, Revised Version of International Search Report, International Preliminary Examination Report and Request for Approval of Drawing Changes 					



21839

U.S. APPLICATION NO (If known, see 37 CFR 1.51) 10/019778		INTERNATIONAL APPLICATION NO PCT/SE00/01416		ATTORNEY'S DOCKET NUMBER 024445-008	
21. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,040.00 (960) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 (970) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 (958) International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 (956) International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 (962)					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$ 1,040.00	
Surcharge of \$130.00 (154) for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)). 20 <input type="checkbox"/> 30 <input type="checkbox"/>				\$ --	
Claims	Number Filed	Number Extra	Rate		
Total Claims	3 -20 =	0	X\$18.00 (966)	\$ 0.00	
Independent Claims	1 -3 =	0	X\$84.00 (964)	\$ 0.00	
Multiple dependent claim(s) (if applicable)			+ \$280.00 (968)	\$ --	
TOTAL OF ABOVE CALCULATIONS =				\$ 1,040.00	
Reduction for 1/2 for filing by small entity, if applicable (see below). +				\$ --	
SUBTOTAL =				\$ 1,040.00	
Processing fee of \$130.00 (156) for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)). 20 <input type="checkbox"/> 30 <input type="checkbox"/>				\$ --	
TOTAL NATIONAL FEE =				\$ 1,040.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 (581) per property +				\$ --	
TOTAL FEES ENCLOSED =				\$ 1,040.00	
				Amount to be refunded:	\$
				charged:	\$
a. <input type="checkbox"/> Small entity status is hereby claimed. b. <input checked="" type="checkbox"/> A check in the amount of \$ <u>1,040.00</u> to cover the above fees is enclosed. c. <input type="checkbox"/> Please charge my Deposit Account No. <u>02-4800</u> in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed. d. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>02-4800</u> . A duplicate copy of this sheet is enclosed. NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: Ronald L. Grudziecki BURNS, DOANE, SWECKER & MATHIS, L.L.P. P.O. Box 1404 Alexandria, Virginia 22313-1404 (703) 836-6620					
			 SIGNATURE Scott W. Cummings NAME		
			41,567 REGISTRATION NUMBER		
			January 4, 2002 DATE		

LOADING SYSTEM FOR PVD COATING OF CUTTING INSERTS

BACKGROUND OF THE INVENTION

The present invention relates to a PVD (Physical
5 Vapour Deposition) batch fixturing system for cutting
inserts, suitable for rational large scale production
and allowing for fully automatic loading.

Physical Vapour Deposition of wear resistant hard
coatings on cemented carbide cutting inserts has been in
10 industrial use for more than 15 years and the practice
of the PVD method is still increasing as is the number
and variety of products subjected to this process.

The PVD process is, in contrast to CVD (Chemical
Vapour Deposition), a line-of-sight process with limited
15 ability to achieve an equal coating thickness around a
three-dimensional body such as a cutting insert. This
fact requires special arrangements for the fixturing sys-
tem; the cutting edges of the individual cemented car-
bide cutting insert as well as the cutting edges of all
20 the inserts in the entire batch must be as equally ex-
posed to the flux of the coating material as possible.
Preferably, the largest coating thickness is to be found
on that part of the insert where it is most required for
the particular cutting operation to be carried out. Fur-
25 thermore, the rake face and the clearance face of the
insert must both be subjected to the least possible ef-
fect of shadowing from the surrounding cutting inserts.
These requirements may lead to a low loading density of
inserts if not specifically designed loading fixtures
30 are being used. A further complication is introduced
when the cutting inserts do not possess any holes in the
centre enabling hanging them on an arrangement of hooks.

There are several methods for loading inserts with-
out holes available but two main principles can be dis-
35 tinguished:

(i) locking the inserts in mechanical fixtures and keeping them in a desired position through e.g. slits or arms

(ii) fixturing the inserts on magnetic holders allowing for the magnetic forces to keep the inserts in a fixed position during the deposition process.

The limitation of method (i), mechanically locking the inserts in fixed positions, is the risk that the locking device itself will shadow an area of the insert that should be coated. The shadowing effect may cause an undesired variation in the coating thickness or, in the worst case, areas that are almost without a coating. It is a disadvantage in cutting operations if the areas with thinner or absent coatings are located within the depth-of-cut area on the insert tool edge. The cosmetic appearance of the insert may also become undesirable with marks and fluctuations in colour that are not the same and alike on all the inserts.

The limitation of method (ii), magnetic holders, is the weight of the magnets which is significant. The high weight of the magnet assembly will restrict the functionality of the mechanism used to rotate the batch in the PVD coating chamber. The rotation is required in order to achieve as equal coating conditions as possible on all the material in the batch. The area of the insert, which is in contact with the magnet, will inevitably remain without a coating restricting the method to be best suited for inserts that may be allowed to have one side or one part of a side without a coating. Furthermore, one requirement of the inserts' geometrical shape would be that of a flat bottom surface to obtain a large enough contact area to the magnet in order to maximize the magnetic force keeping the inserts in place. The magnetic field strength decreases with increasing temperature and the typical PVD substrate tem-

perature range of 450-500°C, also puts specific requirements on the type of magnets that are to be used for this purpose.

A common practice in the prior art is to fixture
 5 the inserts side by side on a four- or six-folded pole. Each side of the pole having an area that allows several inserts to be placed in a two-dimensional pattern. This results in an unfavourable coating thickness distribution. As a consequence of the rotation of the pole, the
 10 clearance faces of the inserts placed along the vertical border of a face of the pole, will obtain thicker coatings than all the other clearance faces of the inserts placed on the same side of the pole. Furthermore, the
 15 parallel positioning of the inserts will cause a shadowing effect on the clearance faces of the inserts, causing a difference in coating thickness between the rake and clearance faces of the inserts. This difference is in certain cases most undesired in cutting operations.

20 OBJECTS AND SUMMARY OF THE INVENTION

It is an object of this invention to provide a fixture system, especially suited for cutting inserts of a specific geometrical shape, of magnetic holders avoiding or alleviating the general limitations of a loading system based on the magnetic principle. Furthermore, it is
 25 an object of the invention to provide a loading system suitable for a rational production in larger scale.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Fig. 1 shows a picture of the presently claimed invention.

Fig. 2 shows a schematic drawing of the presently claimed invention. The invention includes a metallic tube (A) encompassing a stack of alternating discs of
 35 magnets (B) and iron cores (C). A bar (D) passes through the centre of the magnets and iron cores. The bar is

adapted to conform to the rotating construction in the PVD-equipment. The tube is further equipped with reinforcement rings (E).

Fig 3 and 4 display cross-sections of the invented construction with cemented carbide inserts loaded in with different loading densities.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

10 The batch loading system according to the present invention utilizes a tube manufactured of a non-magnetic metallic material, surrounding a stack of alternating discs of magnets and iron discs. The cutting inserts are placed on the outer wall of the solid tube and kept in
15 place by the magnetic forces.

The physical shape of the outer tube in the present invention may be designed in a number of geometrical shapes. The cross-section of the tube may for instance be circular, elliptical, rectangular, quadratic, penta-
20 gonal, hexagonal and so on. In the description of the present invention only the circular cross-section will be described.

The circular shape of the fixture makes it specifically suited for loading inserts with a specific geomet-
25 rical shape. The part of the insert in contact with the tube should preferably have an elongated geometry. One type of inserts that does not posses any central hole and has an elongated bottom surface that is not used in the cutting operation, and which requires an even coat-
30 ing thickness on the rake and the clearance faces, are inserts used for machining operations called parting and grooving. Inserts of this type and other types of inserts with similar qualities are especially suited for the present invention.

35 Fig. 3-4 show that the cylindrical shape of the tube leads to an improved exposure of the clearance

faces in comparison to the inserts being positioned in parallel on a flat surface. The elongated bottom profile of the insert assures a firm contact with the tube. The tubular shape optimizes the ratio between surface area available for loading and volume of magnetic material. Thus, the weight of the fixture is minimized at the same time as the surface area of the fixture is maximized and a high loading density of inserts is allowed.

The arrangement of the magnets is important to the functionality of the loading system. The magnets are orientated with the north poles towards each other. In this way the magnetic field in the iron disc will be amplified and the effect of the magnets is used in an optimal way. The thickness of the magnetic discs in comparison with the thickness of the iron discs is also of importance. The iron disc must be thick enough to act as a buffer between the magnetic fields from the surrounding magnetic discs and thick enough to avoid saturation in magnetic flux. At the same time the iron disc has to be thin enough to avoid self-demagnetisation of the magnets.

The type of magnetic material being used is critical since many of the magnetic materials loose their magnetic properties at elevated temperatures. The material in the iron discs is preferably an iron material with a low content of alloying elements.

The metallic tube should be manufactured of a non-magnetic material, such as for instance stainless steel, in order not to disturb the magnetic flux from the magnetic discs to iron discs. The function of the metallic tube surrounding the magnets is primarily to protect the magnets from physical damage and from being coated. A coated surface will after a number of exposures to the coating process begin to loose particles of the coating. These particles will to a certain extent become attached

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CLAIMS

1. A method of fixturing cutting tool inserts in a PVD (Physical Vapor Deposition) coating equipment
c h a r a t e r i z e d in using a tube manufactured of
5 a non-magnetic metallic material surrounding a stack of
alternating discs of a magnetic material and iron where
the north poles of the magnets are directed towards each
other and the cutting inserts are positioned on the
outer wall of the solid tube and kept in place by the
10 magnetic forces.
2. A method according to claim 1
c h a r a t e r i z e d in that the cross-section of the
tube is circular.
3. A method according to claim 1
15 c h a r a t e r i z e d in that the thickness of the
tube wall is less than 1.5 mm, preferably less than 1.0
mm.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
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PCT

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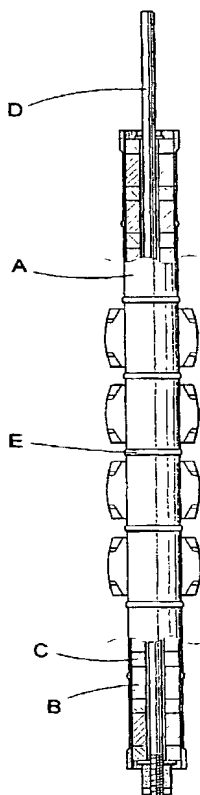
(71) Applicant (*for all designated States except US*): **SAND-
VIK AB**; (publ) [SE/SE]; S-811 81 Sandviken (SE).

*For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.*

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **NORRGRANN,**

(54) Title: **LOADING SYSTEM FOR PVD COATING OF CUTTING INSERTS**

(57) Abstract: The present invention relates to a method of fixturing cutting tool inserts in a PVD (Physical Vapor Deposition) coating equipment. The method consists in using a tube manufactured of a non-magnetic metallic material surrounding a stack of alternating discs of a magnetic material and iron. The north poles of the magnets are directed towards each other and the cutting inserts are positioned on the outer wall of the solid tube and kept in place by the magnetic forces.



WO 01/02620 A1



Fig. 2

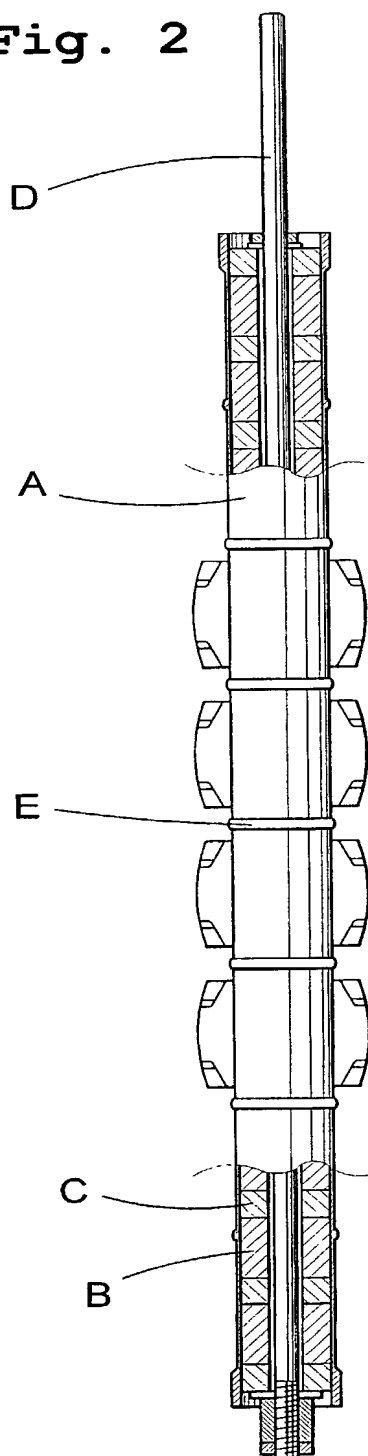


Fig. 3

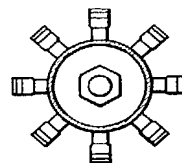
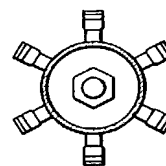


Fig. 4



COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY PATENT APPLICATION

Attorney's Docket No.

024445-008

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (if only one name is listed below) OR AN ORIGINAL, FIRST AND JOINT INVENTOR (if more than one name is listed below) OF THE SUBJECT MATTER WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

LOADING SYSTEM FOR PVD COATING OF CUTTING INSERTS

the specification of which

(check one)

☐

is attached hereto;

☒

was filed on July 4, 2000

as

International Application No. PCT/SE00/01416

and was amended on _____;
(if applicable)

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE;

I ACKNOWLEDGE THE DUTY TO DISCLOSE TO THE OFFICE ALL INFORMATION KNOWN TO ME TO BE MATERIAL TO PATENTABILITY AS DEFINED IN TITLE 37, CODE OF FEDERAL REGULATIONS, Sec. 1.56 (as amended effective March 16, 1992);

I do not know and do not believe the said invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to said application; that said invention was not in public use or on sale in the United States of America more than one year prior to said application; that said invention has not been patented or made the subject of an inventor's certificate issued before the date of said application in any country foreign to the United States of America on any application filed by me or my legal representatives or assigns more than twelve months prior to said application;

I hereby claim foreign priority benefits under Title 35, United States Code Sec. 119 and/or Sec. 365 of any foreign application(s) for patent or inventor's certificate as indicated below and have also identified below any foreign application for patent or inventor's certificate on this invention having a filing date before that of the application(s) on which priority is claimed:

COMBINED DECLARATION AND POWER OF ATTORNEY

Attorney's Docket No.

024445-008

COUNTRY/INTERNATIONAL	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
SWEDEN	9902574-4	5 July 1999	YES <u>X</u> NO <u> </u>
			YES <u> </u> NO <u> </u>

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

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21839

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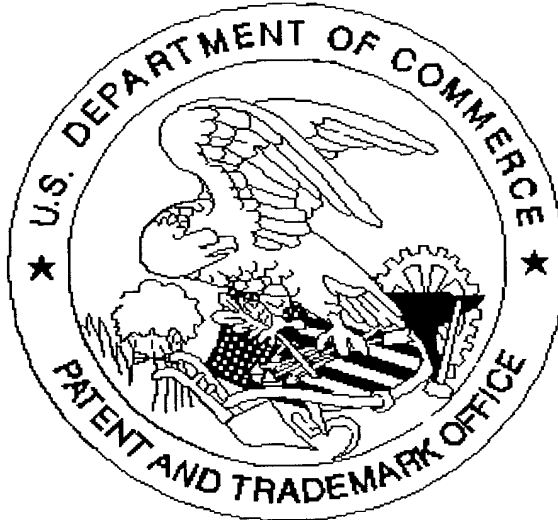
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Drawing figure 1 is dark.